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THE METHOD OF NATURE

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NATURE is creative. This is no new and profound idea originating in the mind of M. Bergson; it is a patent and familiar fact lying on the surface of things. Creation is merely the production of something new. Man creates, but only by application of the creative principles of nature. Nature's creations do not differ in any essential respect from the created products of man. When two or more chemical elements combine by chance in certain proportions the result is something new, something entirely different from either constituent; a product manifesting new properties; it is a creation of nature. Such, for instance, are all the gases, liquids and solids, which go to make up the visible universe. Some of these man recreates by a process of creative synthesis, as, for instance, in synthetic chemistry.

If, then, we conceive the existing universe as having been evolved gradually and naturally, that is, from the operation of inherent forces, and from diffused matter consisting of a few elements or of one; or, in other words, if we accept the current doctrine of evolution; we must recognize that all the various forms of matter, with all their peculiar properties, have come into existence at certain definite times in the past in a natural manner. From a state of existence *de potentia* they passed, sometime and somewhere and for the first time, into a state of existence *de facto*. They were, therefore, at their initial appearance, absolutely new creations. The order of their appearance was more or less serial. Roughly speaking, it was perhaps as follows: the atom, the molecule, the inorganic compound, the organic compound, protoplasm, protists, plants, animals, man, society. The principle involved is that of combination. Nature creates by compounding. Creation is permutation.

Nature, then, is not only "*durch und durch causalität*," as Schopenhauer declared; it is through and through creative. All that now exists, whether in the inorganic, organic, or social worlds, save the relatively few products of man's intelligence, is the outcome of a natural creative process and the manifestation of a natural creative power.

Confining attention, for our present purposes, to the creative principle as manifested in the organic and social worlds, we find it marvelously exemplified in the manifold and myriad forms of plant and animal life, and in the social groups and institutions which have come into existence spontaneously.

With respect to plants and animals there are now known and classified more than two million species, and the number is increasing every day. In the classification of Linnæus, made in 1758, we find included only 4,136 species of animals. In modern classifications the number is multiplied more than a hundred fold. A recent writer places it at 716,000. A speaker at the American Society of Zoologists in 1912 gave a total of 522,400. Jordan and Kellogg, in their book entitled "Animal Studies," state that there are 300,000 named species of insects known to zoologists, and that this number represents only one fifth, or possibly one tenth, of those living throughout the world. Herbert Spencer, in 1852, on the authority of Humboldt and Carpenter, placed the number of animal species at 320,000 and of plants at two million, and declared that

If to that we add the number of animal and vegetable species that have become extinct, we may easily estimate the number of species that have existed and are existing on the earth at not less than ten millions.

Now what created all these forms of life with their infinite variations? Nature. The orthodox religionist would use the interrogative "who," and answer, "God;" and there need be no objection to that reply. But inasmuch as science deals only with secondary causes, not at all with ultimates, the scientific answer must be as given; and there should be no objection on religious grounds to the answer thus made.

Nature, by a distinctively creative process, then, brought into existence all the various species of plant and animal life, and animal and human societies, too; and controls them all in so far as they are not products of conscious human effort. We are aware that an objection may be raised to thus objectifying nature and apparently separating it from its products, but such separation appears to be a necessity of speech, and, aside from noting the possibility of such objection, it need not detain the argument.

Now, nothing is produced, accomplished, or achieved without some describable mode or way of procedure. The mode or way in the process of human achievement is denominated method, and, by a figure of speech, we may employ the same term in describing the creative process of nature. What, then, is nature's method of creation?

In spite of modern criticism of the Darwinian hypothesis, which appears oftentimes to be over-refined or misdirected, it may be said that the method of nature is most adequately described as a process of natural selection, meaning by that expression all that may be rightfully implied. Darwin himself admitted that other factors are involved in the process.

Taking natural selection, then, as the most important means or method of natural creation, we wish to point out some of its most conspicuous characteristics, the range of its application, and the folly of relying upon it for the realization of desirable human ends.

The first element which reveals itself in an analysis of the principle of natural selection is a "multiplication of chances." This is required to furnish opportunity for selection and is occasioned by the fertility of nature. Nature brings into existence many more organisms than can possibly survive. This is necessary in order to secure the requisite number and kinds of variants in a given type of organism to secure survival of the species and progressive adaptation. But it means, so far as any special and particular result is concerned, an enormous waste. The first, and most obvious, characteristic of nature's method is its extraordinary wastefulness.

To appreciate the waste of nature one has but to compare its potential with its actual achievement in the perpetuation of a given type of organism. Among microorganisms the possibilities of increase in number are most astounding. A minute form of life, *hydrotina*, is capable of producing offspring with such rapidity that, in a single year, they would form a sphere whose limits would extend beyond the confines of the known universe. A certain infusorium, *stylonichia*, is said to be capable of producing in six and one half days a mass of protoplasm weighing one kilogram. In thirty days, at the same rate, it could produce a mass a million times larger than the sun, the weight of which in kilograms would have to be represented by a figure followed by forty zeros.¹ A plant which produces only two seeds a year, and there are few, if any, that are not more prolific, would have in the twenty-first year, if none was destroyed, 1,048,576 descendants. A horse-chestnut tree may produce a ton of pollen. A housefly lays a hundred and twenty eggs, and there are twelve to fourteen generations in a season. Counting twelve generations only, a single fly, if all its offspring survived, might be the parent

¹ For these and other striking illustrations of the potential fertility of nature, see Morgan, "Heredity and Sex," p. 2; Marshall, A. M., "Lectures on the Darwinian Theory," pp. 39-40.

of a family numbering 4,253,564,672,000,000,000,000. A salmon lays 15,000 eggs, an octopus, 50,000, a large shad, 100,000, a codfish 1,000,000, an oyster 2,000,000, a conger eel 10,000,000, a tapeworm 1,000,000,000. In 1864 a man living on a sheep ranch near Melbourne, Australia, imported, from the Kew Gardens in London, three pairs of rabbits. In 1906, forty years afterwards, Australia shipped to Europe 25,000,000 frozen rabbits, and 96,000,000 rabbit skins. Horses were introduced in Buenos Ayres in 1537. In forty-three years they had spread to the Straits of Magellan. Fertility diminishes as we rise in the scale of animal life, but even the human being is capable of reproducing with such rapidity that from a single pair, doubling once in fifty years, there would be in three thousand years a sufficient number of human beings to cover the whole surface of the earth, land and sea, and piled on top of one another eight hundred deep. Such are some of the illustrations of the potential natural increase of organisms.

Notwithstanding this enormous fertility of nature, in spite of this enormous multiplication of chances, it is a well-known fact that the number of any given species remains, as a rule, practically the same from year to year. What becomes of the surplus? Why is it that "of fifty seeds She often brings but one to bear"? Obviously the surplus production is wasted, at least so far as the perpetuation of the given species is concerned. Says Asa Gray:

The waste of being is enormous, far beyond the common apprehension. Seeds, eggs, and other germs, are designed to be plants and animals, but not one of a thousand or of a million achieves its destiny. . . . But what of the vast majority that perish? As of the light of the sun, sent forth in all directions, only a minute portion is intercepted by the earth or other planets where some of it may be utilized for present or future life, so of potential organisms, or organisms begun, no larger proportion attain the presumed end of their creation.²

Nature's economy, then, is no economy at all; its order is disorder; its method is the absence of method, if that word be defined in terms of human procedure. The most conspicuous characteristic of nature's mode of action in the process of creation, or of perpetuation, is waste.

This waste is manifested not alone in the number of material products destroyed but also in the amount of time required to produce a given result. Lamarck perceived this. He said,

For nature time is nothing. It is never a difficulty, she always has it

² "Darwiniana," by Asa Gray, New York, 1877, pp. 372-373.

at her disposal; and it is for her the means by which she has accomplished the greatest as well as the least results.

It required millions of years to fashion the earth, millions to populate it with the lower orders of life, perhaps a million to develop man, and thousands of years to produce a civilized people. The method of nature is slow.

Still another, and perhaps more significant fact, is that the method of nature is uncertain, so far as the realization of results desirable to man is concerned. This arises from the absence in all purely natural processes of the aims and purposes of man. All movements of nature, as far as we are able to trace them, are in the direction of balance or adjustment. As to whether the resulting conditions, or the products created thereby, are profitable to man, nature is wholly unconcerned. Whatever else it may be, nature is not Providence. According to the law of probabilities, it must sometimes happen, of course, that in the manifold activities of nature, and in the multiform products resulting from those activities, something will be found conforming to human desires, and certain processes will be directed toward the achievement of desirable human ends. Nevertheless nature is aimless, and the human benefits resulting from the operations of nature's method are wholly accidental.

Such, then, are the leading characteristics of the method of nature; it is wasteful, slow, and aimless, therefore uncertain so far as the production of desirable human results are concerned. Let us now observe the range of its operations.

Obviously the method of nature applies to all movements, and to the creation of all products, in which intelligence is not involved. Such, for instance, are the creation and movements of the planets, of the clouds, of the waves of the sea, of the earth and the convulsions in its crust, and the creation and development of all plants and animals in a state of nature. It should be equally obvious that it applies, also, to all incidental, that is, all unintended, results of intelligent action. But much that happens in human life is incidental to the pursuit of conscious ends; it falls outside of the purposive; it is fortuitous, accidental, and belongs, therefore, in the realm of nature; and anything resulting from it is achieved by nature's method.

With this understanding it is easy to see that many, if not most of the movements of society, whether progressive or regressive, take place in accordance with the method of nature; they are unintended, wholly incidental to the human pursuit of other ends. For it is an obvious fact that individuals in

pursuit of strictly personal ends, and corporate bodies in the pursuit of corporate ends, may affect society for good or ill. So far as society is thus affected it is under the control of nature. Social movements thus produced, social products thus created, are without conscious intent on the part of anybody. As a matter of fact most social movements, most of the social progress of the past, and much of that of to-day, are, socially considered, unconscious and unintended.

Society to-day, then, is still, in large part, under the domain of nature, and the progress achieved is still largely the result of the operations of nature's method. Such progress is, therefore, wasteful, slow, and uncertain. War between social groups, and for national rather than social purposes, and business competition for corporate or individual ends, are often socially progressive in results, but the progress achieved by them is attained by nature's method, and is therefore as wasteful, slow, and uncertain as any of the other operations of nature.

With some of the lower organisms, the domesticated plants and animals, the method of nature has long since been supplanted by artificial selection, and the other more economical methods of mind. Waste is eliminated, development is hastened, new types are developed, change is directed toward a predetermined goal.

The same thing might be and should be true of social change. As society is a product of nature, and its movements subject to natural law, it may be modified by the intelligence and will of man. Its progress, as achieved by the method of nature, is wasteful, slow and uncertain. We should no more rely upon the method of nature to bring about a high form of civilization than we should rely upon that method to bring into existence the particular types of plants and animals most serviceable to man. He who hopes that the natural method of social development will of itself produce democracy, for instance, or permanent peace, or that the brotherhood of man will inevitably be reached as a natural goal, is in like case with the foolish optimist who expects a good crop to be grown without cultivation or a Micawber who expectantly waits for something favorable to turn up. It is man's prerogative to supplant, in the whole field of natural phenomena, the method of nature by the method of mind, and thus to control social events and social progress as he has long been controlling the progress of the domesticated plants and animals, and many of the processes of the physical world.

If this idea, and this possibility, ever should become real-

ized, they must necessarily involve, as a preliminary step, the development of a social consciousness as distinguished from the narrower group consciousnesses which now prevail, and in which the latter will merge. This necessarily means a league of nations, and the surrender, on the part of national groups, of independent national sovereignty. To the idea of the necessity of such a league many have already come. The conception is generally limited, however, to that of a league to secure and maintain international peace. But, if the method of nature is to be supplanted in the progress of society, the functions of such a league must be carried far beyond the establishment and maintenance of peace. It will not be enough to create a league within which the method of nature is to operate in the wasteful, even though peaceful, struggles of groups, in a "war after the war." There must be definite, constructive purposes looking to the elimination of strife and petty jealousies, and the organization of all the resources of society in the interest of human happiness. The internal operations of society must also be brought under social control, and social control, no matter where it is exercised, means the supplanting of nature's methods by the more economical methods of intelligence.

A league of nations, then, is necessary, and we do well to urge its formation. But if social progress is ever to become orderly, if we are ever to eliminate its terrible waste, if social change is ever to become certainly progressive, if we are to approach with even pace the social conditions of which already many have dared to dream, the method of nature must be supplanted everywhere throughout the realm of human interests, and society become a work of art, and not remain as it now is, largely a product of nature. Can this be done? Is man, who controls with such wonderful results the physical forces, and who determines in large measure the destiny of all lower creatures, powerless to determine the destiny of society? Shall it be said of Man, as it was said of the Son of Man, "He saved others, himself he cannot save"? The achievements of science in every domain of natural phenomena, the gradual extension of a social art based on a science of society, deny it, and give ground for a more optimistic social philosophy.